

### **Claims**

1. A method of processing data received in a transport stream format to produce a modified transport stream for recording on a recording medium to  
5 record the content of a selected audio-visual programme (hereinafter referred to as the wanted content), the received transport stream comprising a multiplex of elementary streams conveying not only the wanted content but also the content of other programmes not to be recorded (the unwanted content), said elementary streams of data having been encoded, divided into  
10 elementary stream (ES) packets with packet headers, the ES packets further sub-divided into a plurality of smaller transport packets, and the transport packets of the first and second elementary streams interleaved in the received transport stream with each other and with transport packets carrying data from neither stream, wherein the said modified transport stream is produced by:
- 15 - identifying and selecting received transport packets which correspond to the wanted content;
- recording the selected transport packets within a recording medium to form said modified transport stream, so as to preserve compliance with a transport stream target decoder model substantially without re-packetising or  
20 remultiplexing the streams; and
- recording auxiliary information on the same recording medium for use by a reproducing apparatus in gaining access to the content of the modified transport stream via any of a set of potential entry points throughout the wanted content.
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2. A method as claimed in claim 1 wherein said auxiliary information includes information stored in a file separately from a file holding the modified transport stream.
- 30 3. A method as claimed in claim 2 wherein said auxiliary information

comprises an index listing characteristic points within at least one of the wanted elementary streams, and is obtained by parsing the elementary stream to identify individual access units offering a valid entry point for decoding said at least one elementary stream.

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4. A method as claimed in claim 3 wherein said characteristic points are defined with a frequency substantially greater than one per second on the presentation time scale.

10 5. A method as claimed in claim 3 wherein said characteristic points are defined with reference to a video elementary stream, each referring to an intra-coded picture data.

6. A method as claimed in claim 1 wherein at least part of said auxiliary  
15 information is recorded within the modified transport stream.

7. A method as claimed in claim 1 wherein the received transport stream occasionally includes stream mapping information identifying a transport packet ID code associated with each elementary stream, said stream mapping  
20 information being used to identify the wanted content and being subject to change throughout the received transport stream, and wherein at least part of said auxiliary information is created by parsing the received transport stream to extract the mapping information, and recorded so that current mapping information is accessible at each potential entry point without parsing the  
25 modified transport stream prior to the entry point.

8. A method as claimed in claim 6 wherein at least part of said auxiliary information comprises additional transport packets inserted at each potential entry point in the modified transport stream.

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9. A method as claimed in claim 6, wherein at least part of said auxiliary information overwrites header information received within the transport packets, in order to define the modified transport stream.

5 10. A method as claimed in claim 9 wherein the received transport stream occasionally includes stream mapping information identifying a transport packet ID code associated with each elementary stream, said stream mapping information being used to identify the wanted content and being subject to change throughout the received transport stream, wherein said auxiliary  
10 information overwrites packet ID codes in the transport packets so as to re-map the wanted content to a uniform set of ID codes throughout the modified transport stream.

11. A method as claimed in claim 1, including the steps of :

- 15 - identifying in the received data an elementary stream conveying auxiliary data useful in playback of the programme to be recorded; and
- in the case where the elementary stream conveying the auxiliary data is one conveying part of the unwanted content, generating a new elementary stream conveying the auxiliary data without the unwanted content.

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12. A method according to claim 11 wherein the auxiliary data comprises clock reference data for synchronising playback of the elementary streams.

13. A method as claimed in claim 1, wherein said elementary streams  
25 comprise at least video and audio of an audio-visual programme to be recorded .

14. A method as claimed in claim 1, wherein said received transport stream is compliant with the MPEG transport stream specification.

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15. A method as claimed in claim 1, further comprising:

- reproducing stored programme segments with a timing different to that of the received transport stream, in accordance with user command, by reading the recorded auxiliary information and using it to enter and commence  
5 reproduction by reading said modified transport stream from a desired entry point.

16. A method as claimed in claim 15 wherein said reproducing is performed to effect a trick play mode of a frame-based elementary stream, using the  
10 auxiliary information to step through the programme while presenting a subset of frames to a user, by reading said modified transport stream at a succession of entry points.

17. A method as claimed in claim 15 wherein said auxiliary information is  
15 read and used implicitly as part of a standard decoding of the modified transport stream.

18. A method as claimed in claim 15 wherein said auxiliary information is read and used to modify further the transport stream as reproduced from the  
20 recording medium, prior to standard decoding of the further modified transport stream.

19. A recording medium wherein a modified transport stream has been recorded by a method as claimed in claim 1.

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20. A signal conveying a modified transport stream to or from a recording medium, wherein the modified transport stream has been modified by a method as claimed in claim 1.

30 21. A signal as claimed in claim 20 wherein said modified transport stream

has been reproduced from said recording medium by a method as claimed in claim 15.

22. An apparatus for recording a multiplex of elementary stream data  
5 received in a transport format the apparatus comprising means specifically adapted to generate and record a modified transport stream by a method as claimed in claim 1.

23. An apparatus as claimed in claim 22 further comprising means for  
10 reproducing said modified transport stream by a method as claimed in claim 15.

24. A method of processing a received data stream to produce a modified stream for recording on a recording medium to record the content of a  
15 selected audio-visual programme (hereinafter referred to as the wanted content), the received data stream comprising a multiplex of elementary streams conveying not only the wanted content but also the content of other programmes not to be recorded (the unwanted content), the method comprising:

- 20 – identifying and extracting from the received data stream the elementary data stream(s) conveying the wanted content;
- identifying in the received data an elementary stream conveying auxiliary data useful in playback of the programme to be recorded;
- in the case where the elementary stream conveying the auxiliary data is  
25 one conveying part of the unwanted content, generating a new elementary stream conveying the auxiliary data without that part of the unwanted content; and
- multiplexing together the elementary stream(s) extracted from the received stream with the new elementary stream to form said modified data stream  
30 for recording.

25. A method according to claim 24 wherein the auxiliary data comprises a clock reference data for synchronising playback of the audio-visual programme.

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26. A method according to claim 24 wherein the received data stream is an MPEG-compliant Transport Stream as defined in ISO/IEC 13818-1 and the auxiliary data comprises the Program Clock Reference (PCR) as defined therein.

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27. A method of processing data received in a transport stream format to produce a modified transport stream for recording on a recording medium to record the content of a selected audio-visual programme (hereinafter referred to as the wanted content), said elementary streams of data having been  
15 encoded, divided into elementary stream (ES) packets with packet headers, the ES packets further sub-divided into a plurality of smaller transport packets, and the transport packets of the first and second elementary streams interleaved in the received transport stream with each other and with transport packets carrying data from neither stream, and wherein the received transport  
20 stream occasionally includes stream mapping information identifying a transport packet ID code associated with each elementary stream, said stream mapping information being subject to change throughout the received transport stream, wherein the said modified transport stream is produced by:

- identifying received transport packets which correspond to the wanted  
25 content using said stream mapping information;
- modifying packet ID codes in the transport packets so as to re-map the wanted content to a uniform set of ID codes according to their content type;
- recording the selected transport packets within a recording medium to form said modified transport stream, thereby to preserve compliance with a  
30 transport stream target decoder model and provide a greater number of

potential entry points than in the received stream.

28. A method of processing data received in a transport stream format to produce a modified transport stream for recording on a recording medium to  
5 record the content of a selected audio-visual programme (hereinafter referred to as the wanted content), said elementary streams of data having been encoded, divided into elementary stream (ES) packets with packet headers, the ES packets further sub-divided into a plurality of smaller transport packets, and the transport packets of the first and second elementary streams  
10 interleaved in the received transport stream with each other and with transport packets carrying data from neither stream, and wherein the received transport stream occasionally includes stream mapping information identifying a transport packet ID code associated with each elementary stream, said stream mapping information being subject to change throughout the received  
15 transport stream, wherein the said modified transport stream is produced by:

- identifying received transport packets which correspond to the wanted content using said stream mapping information;
- parsing the receive transport packets to obtain said mapping information for potential entry points throughout at least on of the elementary  
20 streams;
- recording the selected transport packets together with said auxiliary information within a recording medium to form said modified transport stream, thereby to preserve compliance with a transport stream target decoder model and while providing a greater number of potential entry points than in the  
25 received stream.

29. A method as claimed in claim 27 wherein at least part of said auxiliary information comprises additional transport packets inserted to reproduce current mapping information at each potential entry point in the modified  
30 transport stream.

30. A recording medium wherein a modified transport stream has been recorded by a method as claimed in claim 24.

5 31. A signal conveying a modified transport stream to or from a recording medium, wherein the modified transport stream has been modified by a method as claimed in claim 24.

32. An apparatus for recording a multiplex of elementary stream data  
10 received in a transport format the apparatus comprising means specifically adapted to generate and record a modified transport stream by a method as claimed in claim 24.

33. An apparatus as claimed in claim 32 further comprising means for  
15 reproducing said modified transport stream by a method as claimed in any of claim 15.

34. A recording medium wherein a modified transport stream has been recorded by a method as claimed in claim 27.

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35. A signal conveying a modified transport stream to or from a recording medium, wherein the modified transport stream has been modified by a method as claimed in claim 27.

25 36. An apparatus for recording a multiplex of elementary stream data received in a transport format the apparatus comprising means specifically adapted to generate and record a modified transport stream by a method as claimed in claim 27.

30 37. A recording medium wherein a modified transport stream has been



recorded by a method as claimed in claim 28.

38. A signal conveying a modified transport stream to or from a recording medium, wherein the modified transport stream has been modified by a method as claimed in claim 28.

39. An apparatus for recording a multiplex of elementary stream data received in a transport format the apparatus comprising means specifically adapted to generate and record a modified transport stream by a method as claimed in claim 28.